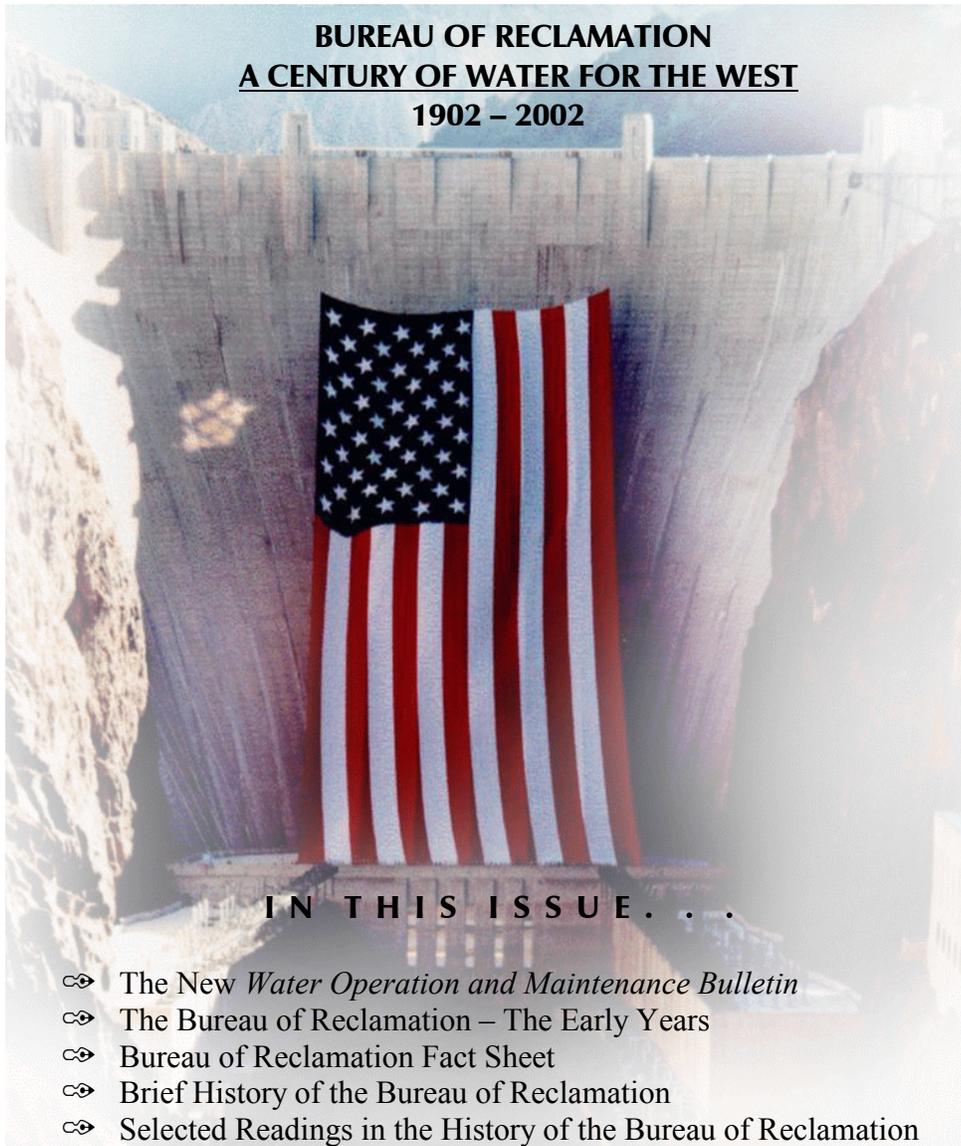


# WATER OPERATION AND MAINTENANCE BULLETIN

No. 200

June 2002



**BUREAU OF RECLAMATION**  
**A CENTURY OF WATER FOR THE WEST**  
**1902 – 2002**

**IN THIS ISSUE . . .**

- ☞ The New *Water Operation and Maintenance Bulletin*
- ☞ The Bureau of Reclamation – The Early Years
- ☞ Bureau of Reclamation Fact Sheet
- ☞ Brief History of the Bureau of Reclamation
- ☞ Selected Readings in the History of the Bureau of Reclamation

**UNITED STATES DEPARTMENT OF THE INTERIOR**

**Bureau of Reclamation**

Available on the Internet at: <http://www.usbr.gov/infrastr/waterbull>

This *Water Operation and Maintenance Bulletin* is published quarterly for the benefit of water supply system operators. Its principal purpose is to serve as a medium to exchange information for use by Bureau of Reclamation personnel and water user groups in operating and maintaining project facilities.

The *Water Operation and Maintenance Bulletin* and subject index may be accessed on the Internet at: **<http://www.usbr.gov/infrastr/waterbull>**

Although every attempt is made to ensure high quality and accurate information, the Bureau of Reclamation cannot warrant nor be responsible for the use or misuse of information that is furnished in this bulletin.

---

---

For further information about the *Water Operation and Maintenance Bulletin*, contact:

**Jerry Fischer, Managing Editor**  
**Bureau of Reclamation**  
**Inspections and Emergency Management Group**  
**Code D-8470**  
**PO Box 25007, Denver, Colorado 80225-0007**  
**Telephone: (303) 445-2748**  
**FAX: (303) 445-6381**  
**Email: [jfischer@do.usbr.gov](mailto:jfischer@do.usbr.gov)**

---

---

*Cover photograph: The Bureau of Reclamation celebrates its 100<sup>th</sup> anniversary as an agency of the Government. The celebration occurred on June 17, 2002, at Hoover Dam.*

Any information contained in this bulletin regarding commercial products may not be used for advertisement or promotional purposes and is not to be construed as an endorsement of any product or firm by the Bureau of Reclamation.

**WATER OPERATION AND MAINTENANCE BULLETIN**  
**No. 200—June 2002**

**CONTENTS**

	<i>Page</i>
The New <i>Water Operation and Maintenance Bulletin</i> .....	1
The Bureau of Reclamation – The Early Years .....	7
Bureau of Reclamation Fact Sheet .....	9
Brief History of the Bureau of Reclamation .....	11
Selected Readings in the History of the Bureau of Reclamation .....	23

## THE NEW WATER OPERATION AND MAINTENANCE BULLETIN

The year 2002 is a special year because of two notable milestones of interest: (1) the United States Bureau of Reclamation, developer and distributor of water in the Western United States, celebrates its 100<sup>th</sup> anniversary as an agency of the Government (1902 – 2002) and (2) the *Water Operation and Maintenance Bulletin*, first published in 1952, has now reached the 200<sup>th</sup> issue in June of this year. When first published in 1952, the bulletin was named *Operation and Maintenance - Equipment and Procedures*. With the 50<sup>th</sup> issue in 1964, the name was changed to *Irrigation Operation and Maintenance*. With the 75<sup>th</sup> bulletin in 1971, the name was changed to *Water Operation and Maintenance*. This name remained until 1996 (the 177<sup>th</sup> issue). With the 177<sup>th</sup> issue, the bulletin was renamed to the *Water Operation and Maintenance Bulletin*. This title is currently used.

With the publication of the 200<sup>th</sup> issue in June 2002, we also unveil the new *Water Operation and Maintenance Bulletin* web site. All previous bulletins (from No. 1 to the current No. 200 edition) are posted on the site. As before, you may view or print any bulletin from the site as needed. With these electronic versions available, the need to reproduce copies of the old, rare, and fragile issues will be alleviated. The address of the bulletin remains the same: <[www.usbr.gov/infrastr/waterbull](http://www.usbr.gov/infrastr/waterbull)>.

Links on the home page (figure 1) will direct the user to all other locations on the site. The “Current Bulletin” link is located at the top of the home page. The “Previous Bulletins” table is below the “Current Bulletin” link and is divided into groups of 10 years (a decade) each. Choosing a decade will take you to the page listing all issues during that timeframe (figure 2). Any issue links at this point will display the chosen issue as an Adobe PDF file. If the selected issue is larger than usual, it will be broken down into smaller parts labeled Part A, Part B, Part C, etc., on a separate “Multi-Part Bulletins” page (figure 3). The next section of the home page is the “Bulletin Subject Index.” Here you can look for your subject or topic of interest. After each subject entry, the bulletin issue number addressing that point of interest will be listed. Then, you can go back to the “Previous Bulletins” table for retrieval of that issue. The last section is “Spanish Bulletins.” Here we have posted the past bulletins (No. 144 through No. 165) that have been translated into Spanish and published. Selecting this link will take you to the “Spanish Bulletins” page (figure 4). All of the above-mentioned pages have a “Return to Home Page” link near the upper right corner.

Enjoy the bulletins, old and new. Following the advance of technology through the last 50 years is enlightening and educational.

---



**Bureau of Reclamation**  
Managing Water In The American West

## WATER OPERATION AND MAINTENANCE BULLETIN

If you need ADOBE ACROBAT READER, get it here: [GET ACROBAT READER](#)

**CURRENT BULLETIN**  
June 2002, No. 200

**PREVIOUS BULLETINS**

2000 - 2009 No. 191 - 200	1990 - 1999 No. 151 - 190	1980 - 1989 No. 111 - 150	1970 - 1979 No. 71 - 110	1960 - 1969 No. 31 - 70	1952 - 1959 No. 1 - 30
------------------------------	------------------------------	------------------------------	-----------------------------	----------------------------	---------------------------

**BULLETIN SUBJECT INDEX**  
[A](#)--[B](#)--[C](#)--[D](#)--[E](#)--[F](#)--[G](#)--[H](#)--[I](#)--[J](#)--[K](#)--[L](#)--[M](#)--[N](#)--[O](#)--[P](#)--[Q](#)--[R](#)--[S](#)--[T](#)--[U](#)--[V](#)--[W](#)--[X](#)--[Y](#)--[Z](#)

**SPANISH BULLETINS**  
A limited number of bulletins are available in Spanish Language translation.  
Un numero limitado de bulletines traducidos en el idioma espanol estan disponibles.

[Bulletines en espanol](#) (No. 144 - 165 con Indice)

Figure 1.—Water Operation and Maintenance Bulletin home page.



**WATER OPERATION AND MAINTENANCE BULLETINS**

**1990 - 1999**

The following Bulletins may be downloaded now. They are large files in ADOBE PDF format.  
If you need ADOBE ACROBAT READER, get it here: [GET ACROBAT READER](#)

1999	<a href="#">December No. 190</a>	<a href="#">September No. 189</a>	<a href="#">June No. 188</a>	<a href="#">March No. 187</a>
1998	<a href="#">December No. 186</a>	<a href="#">September No. 185</a>	<a href="#">June No. 184</a>	<a href="#">March No. 183</a>
1997	<a href="#">December No. 182</a>	<a href="#">September No. 181</a>	<a href="#">June No. 180</a>	<a href="#">March No. 179</a>
1996	<a href="#">December No. 178</a>	<a href="#">September No. 177</a>	<a href="#">June No. 176</a>	<a href="#">March No. 175</a>
1995	<a href="#">December No. 174</a>	<a href="#">September No. 173</a>	<a href="#">June No. 172</a>	<a href="#">March No. 171</a>
1994	<a href="#">December No. 170</a>	<a href="#">September No. 169</a>	<a href="#">June No. 168</a>	<a href="#">March No. 167</a>
1993	<a href="#">December No. 166</a>	<a href="#">September No. 165</a>	<a href="#">June No. 164</a>	<a href="#">March No. 163</a>
1992	<a href="#">December No. 162</a>	<a href="#">September No. 161</a>	<a href="#">June No. 160</a>	<a href="#">March No. 159</a>
1991	<a href="#">December No. 158</a>	<a href="#">September No. 157</a>	<a href="#">June No. 156</a>	<a href="#">March No. 155</a>
1990	<a href="#">December No. 154</a>	<a href="#">September No. 153</a>	<a href="#">June No. 152</a>	<a href="#">March No. 151</a>

Figure 2.—Water Operation and Maintenance Bulletin issues listed by decade.



**WATER OPERATION AND MAINTENANCE BULLETINS**

**MULTI-PART BULLETINS**

*This Page Contains The Larger Bulletins In Multiple Parts Due To Size*

1998 - March No. 183	Part-A - Part-B
1993 - December No. 166	Part-A - Part-B
1992 - December No. 162	Part-A - Part-B
1992 - June No. 160	Part-A - Part-B - Part-C
1991 - March No. 155	Part-A - Part-B - Part-C
1990 - September No. 153	Part-A - Part-B
1988 - March No. 143	Part-A - Part-B
1987 - December No. 142	Part-A - Part-B - Part-C
1977 - March No. 099	Part-A - Part-B
1976 - September No. 097	Part-A - Part-B - Part-C - Part-D - Part-E - Part-F - Part-G - Part-H - Part-I
1969 - September No. 069	Part-A - Part-B
1969 - June No. 068	Part-A - Part-B
1968 - December No. 066	Part-A - Part-B
1967 - June No. 060	Part-A - Part-B - Part-C
1964 - December No. 050	Part-A - Part-B
1961 - September No. 037	Part-A - Part-B - Part-C - Part-D - Part-E - Part-F - Part-G - Part-H
1959 - September No. 029	Part-A - Part-B
1956 - June No. 016	Part-A - Part-B
1955 - December No. 014	Part-A - Part-B
1953 - April No. 003	Part-A - Part-B - Part-C - Part-D

Figure 3.—Water Operation and Maintenance Bulletin multi-part issues.



**Bulletines de Operacion de Aguas y Mantenimiento**

**BULLETINE EN ESPANOL**  
**1989 - 1993**

Si Uds necesitan el "ADOBE ACROBAT READER". Obtengalo aqui usando ["GET ACROBAT READER"](#)

[Indice del Bulletine en Espanol \(No. 1 - 164\)](#)

1993		Septiembre No. 165	Junio No. 164	Marzo No. 163
1992	Diciembre No. 162	Septiembre No. 161	Junio No. 160	Marzo No. 159
1991	Diciembre No. 158	Septiembre No. 157	Junio No. 156	Marzo No. 155
1990	Diciembre No. 154	Septiembre No. 153	Junio No. 152	Marzo No. 151
1989	Diciembre No. 150	Septiembre No. 149	Junio No. 148	Marzo No. 147
1988	Diciembre No. 146	Septiembre No. 145	Junio No. 144	

Figure 4.—Water Operation and Maintenance Bulletin issues in Spanish.

## THE BUREAU OF RECLAMATION – THE EARLY YEARS

Inadequate precipitation in the American West required settlers to use irrigation for agriculture. At first, settlers simply diverted water from streams, but in many areas, demand outstripped supply. As demand for water increased, settlers wanted to store “wasted” runoff from rain and snow for later use, thus maximizing use by making more water available in drier seasons. At that time, private and State-sponsored storage and irrigation ventures were pursued but often failed because of lack of money and/or lack of engineering skill.

Pressure mounted for the Federal Government to undertake storage and irrigation projects. Congress had already invested in America's infrastructure through subsidies to roads, river navigation, harbors, canals, and railroads. Westerners wanted the Federal Government also to invest in irrigation projects in the West. The irrigation movement demonstrated its strength when pro-irrigation planks found their way into both Democratic and Republican platforms in 1900. Eastern and Midwestern opposition in the Congress quieted when Westerners filibustered and killed a bill containing rivers and harbors projects favored by opponents of Western irrigation. Congress passed the Reclamation Act of June 17, 1902. The act required that water users repay construction costs from which they received benefits.

In the jargon of that day, irrigation projects were known as “reclamation” projects. The concept was that irrigation would “reclaim” arid lands for human use. In addition, “homemaking” was a key argument for supporters of reclamation. Irrigation's supporters believed reclamation programs would encourage Western settlement, making homes for Americans on family farms. President Theodore Roosevelt supported the reclamation movement because of his personal experience in the West, and because he believed in homemaking.

In July 1902, in accordance with the Reclamation Act, Secretary of the Interior Ethan Allen Hitchcock established the United States Reclamation Service within the U.S. Geological Survey (USGS). The new Reclamation Service studied potential water development projects in each Western State with Federal lands—revenue from the sale of Federal lands was the initial source of the program's funding. Because Texas had no Federal lands, it did not become a Reclamation State until 1906, when Congress passed a special Act including it in the provisions of the Reclamation Act.

From 1902 to 1907, Reclamation began about 30 projects in Western States. Then, in 1907, the Secretary of the Interior separated the Reclamation Service from the USGS and created an independent bureau within the Department of the Interior. In the early years, many projects encountered problems: lands/soils included in projects were unsuitable for irrigation, land speculation sometimes resulted in poor settlement patterns, proposed repayment schedules could not be met by irrigators who had high land preparation and facilities construction costs, settlers were inexperienced in irrigation farming, waterlogging of irrigable lands required expensive drainage projects, and projects were built in areas which could only grow low-value crops. In 1923, the agency was renamed the “Bureau of Reclamation.” Then,

---

in the face of increasing settler unrest and financial problems for the reclamation program, in 1924, the “Fact Finder's Report” spotlighted the issues. The Fact Finders Act in late 1924 sought to resolve some of the financial and other problems.

In 1928, Congress authorized the Boulder Canyon (Hoover Dam) Project, and large appropriations began, for the first time, to flow to Reclamation from the general funds of the United States. The authorization came only after a hard-fought debate about the pros and cons of public power versus private power.

The heyday of Reclamation construction of water facilities occurred during the Depression and the 35 years after World War II. The last major authorization for construction projects occurred in the late 1960s while a parallel evolution and development of the American environmental movement began to result in strong opposition to water development projects. Even the 1976 failure of Teton Dam as it filled for the first time did not diminish Reclamation's strong international reputation in water development circles. However, this first and only failure of a major Reclamation dam did shake the bureau which subsequently developed a very strong dam safety program designed to avoid similar problems in the future. However, the failure of Teton Dam, the environmental movement, and the announcement of President Jimmy Carter's “hit list” on water projects profoundly affected the direction of Reclamation's programs and activities in the United States.

Reclamation operates about 180 projects in the 17 Western States. The total Reclamation investment for completed project facilities in September 1992 was about \$11.0 billion. Reclamation projects provide agricultural, household, and industrial water to about one-third of the population of the American West. About 5 percent of the land area of the West is irrigated, and Reclamation provides water to about one-fifth of that acreage (in 1992, approximately 9,120,000 acres). Reclamation is a major American generator of electricity. In 1993, Reclamation had 56 powerplants online and generated 34.7 billion kilowatthours of electricity.

Between 1988 and 1994, Reclamation underwent major reorganization as construction on projects authorized in the 1960s and earlier drew to an end. Reclamation wrote that “The arid West essentially has been reclaimed. The major rivers have been harnessed and facilities are in place or are being completed to meet the most pressing current water demands and those of the immediate future.” Emphasis in Reclamation programs shifted from construction to operation and maintenance of existing facilities. Reclamation's redefined official mission is to “manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.” In redirecting its programs and responsibilities, Reclamation substantially reduced its staff levels and budgets, but remains a significant Federal agency in the West.

---

## BUREAU OF RECLAMATION FACT SHEET

### **Mission**

To manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

### **Operation**

- ☞ Nation's largest wholesale water supplier
- ☞ Sixth largest electric utility in the 17 Western States
- ☞ 58 hydroelectric powerplants producing 42 billion kilowatthours annually
- ☞ 10 trillion gallons of water delivered to 31 million people each year
- ☞ One out of 5 Western farmers (140,000) receive Reclamation's irrigation water for 10 million farmland acres, producing 60 percent of the vegetables and 25 percent of the fruits and nuts in the United States
- ☞ 90 million people annually visit Reclamation's 300 recreation sites
- ☞ Budget: \$796 million
- ☞ Workforce: 6,000

Reclamation has shifted its emphasis from a civil works construction agency to a premier water resource manager focusing on the following priorities:

### **Water Resources Management**

- ☞ Meet increasing water demands through reclamation and reuse
  - ☞ Maintain water quality
  - ☞ Encourage water conservation through grants, partnerships, technical assistance, and incentive programs
-

### **Environmental Restoration and Protection**

- ☞ Preserve and enhance fish and wildlife habitat, including endangered species
- ☞ Operate fish hatcheries
- ☞ Restore migrating fish populations

### **Facilities Operation and Maintenance**

- ☞ Protect the infrastructure
- ☞ Deliver water and power benefits
- ☞ Collect revenues
- ☞ Strengthen dam safety program
- ☞ Promote water transfers
- ☞ Develop and enhance recreational facilities

### **Research and Development of New Technologies**

- ☞ Water resources distribution and movement support systems
- ☞ Protection of reservoir water quality, habitats, and environment
- ☞ Increase reliability of infrastructure and power systems

### **Outreach**

- ☞ Support self-determination efforts of Native American Tribes
  - ☞ Assist other nations to improve their water supplies
-

## BRIEF HISTORY OF THE BUREAU OF RECLAMATION

### The Movement for Reclamation

Only about 2.6 percent of the Earth's water supply is fresh, and about two-thirds of that is frozen in icecaps and glaciers or locked up in some other form such as moisture in the atmosphere or groundwater. That leaves less than eight-tenths of 1 percent of the Earth's water, about 30 percent of fresh water, available for human use. The largely arid American West receives a distinctly small share of that available supply of fresh water. As a result, water is a dominating factor in the arid West's prehistory and history because it is required for occupation, settlement, agriculture, and industry.

The snowmelt and gush of spring and early summer runoff frustrated early Western settlers. They watched helplessly as water they wanted to use in the dry days of late summer disappeared down Western watercourses. Settlers responded by developing water projects and creating complicated Western water law systems, which varied in detail among the various States and territories but generally allocated property rights in available water based on the concept of prior appropriation (first in time, first in right) for beneficial use.

At first, water development projects were simple. Settlers diverted water from a stream or river and used it nearby; but, in many areas, the demand for water outstripped the supply. As demands for water increased, settlers wanted to store "wasted" runoff for later use. Storage projects would help maximize water use and make more water available. Unfortunately, private and State-sponsored irrigation ventures often failed because of lack of money and/or lack of engineering skill. This resulted in mounting pressure for the Federal Government to develop water resources.

In the jargon of the day, irrigation projects were known as "reclamation" projects. The concept was that irrigation would "reclaim" or "subjugate" arid lands for human use. John Wesley Powell's Western explorations and his published articles and reports; private pressures through publications, irrigation organizations, and irrigation "congresses"; nonpartisan Western political pressures; and Federal Government studies conducted by the U.S. Army Corps of Engineers and U.S. Geological Survey (USGS) contributed to the discussions and cogitations that influenced American public opinion, Congress, and the Executive branch in support of "reclamation."

During their period of dominion, the Spanish and Mexican governments in the American Southwest supported settlement and irrigation through their land grant systems. Before 1900, the United States Congress had already invested heavily in America's infrastructure. Roads, river navigation, harbors, canals, and railroads had all received major subsidies. A tradition of government subsidization of settlement of the "West" was longstanding when, in 1866, Congress passed "An Act Granting the Right-of-Way to Ditch and Canal Owners over the

---

Public Lands, and for other Purposes.” A sampling of subsequent congressional actions promoting irrigation reveals passage of the Desert Land Act in 1877 and the Carey Act in 1894, which were intended to encourage irrigation projects in the West. In addition, beginning in 1888, Congress appropriated money to the USGS to study irrigation potential in the West. Then, in 1890 and 1891, while that irrigation study continued, Congress passed legislation reserving rights-of-way for reservoirs, canals, and ditches on lands then in the public domain. However, westerners wanted more; they wanted the Federal Government to invest directly in irrigation projects. The “reclamation” movement demonstrated its strength when pro-irrigation planks found their way into both Democratic and Republican platforms in 1900. In 1901, “reclamation” gained a powerful supporter in Theodore Roosevelt when he became President after the assassination of William McKinley.

### **Reclamation Becomes a Federal Program**

President Roosevelt supported the “reclamation” movement because of his personal experience in the West, and because of his “conservation” ethic. At that time, “conservation” meant a movement for sustained exploitation of natural resources by man through careful management for the good of the many. President Roosevelt also believed “reclamation” would permit “homemaking” and support the agrarian Jeffersonian Ideal. Reclamation supporters believed the program would make homes for Americans on family farms. Passed in both Houses of Congress by wide margins, President Roosevelt signed the Reclamation Act in June 1902.

In July 1902, Secretary of the Interior Ethan Allen Hitchcock established the United States Reclamation Service (USRS) within the Division of Hydrography in the USGS. Charles D. Walcott, as director of the USGS, became the first “director” of the USRS, and Frederick Newell became the first “Chief Engineer” while continuing his responsibilities as chief of the Division of Hydrography.

The Reclamation Act required that

Nothing in this act shall be construed as affecting or intended to affect or in any way interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution of water . . . or any vested right acquired thereunder, and the Secretary of the Interior . . . shall proceed in conformity with such laws. . .

That meant implementation of the act required that Reclamation comply with numerous and often widely varying State and territorial legal codes. Development and ratification over the years of numerous interstate compacts governing the sharing of streamflows between States and of several international treaties governing the sharing of streams by the United States with Mexico or Canada made Reclamation’s efforts to comply with State or territorial water law even more complex.

---

In its early years, the Reclamation Service relied heavily on the USGS Division of Hydrography's previous studies of potential projects in each Western State with Federal lands—the sale of which was the original source of reclamation funding. Between 1903 and 1906, about 25 projects were authorized throughout the West. Because Texas had no Federal lands, it was not one of the original “reclamation” States. It became a reclamation State in 1906.

## **Principles of the Reclamation Program**

During its early years, several basic principles underlay the reclamation program. The details have changed over the years, but the general principles remain: (1) Federal monies spent on reclamation water development projects which benefitted water users would be repaid by the water users; (2) projects remain Federal property even when the water users repay Federal construction costs (the Congress could, of course, choose to dispose of title to a project); (3) Reclamation generally contracts with the private sector for construction work; (4) Reclamation employees administer contracts to ensure that contractors' work meets Government specifications; (5) in the absence of acceptable bids on a contract, Reclamation, especially in its early years, would complete a project by “force account” (that is, would use Reclamation employees to do the construction work); and, (6) hydroelectric power revenues could be used to repay project construction charges.

## **Early History of Reclamation**

In 1907, the USRS separated from the USGS to become an independent bureau within the Department of the Interior. Congress and the Executive Branch, including USRS, were then just beginning a learning period during which the economic and technical needs of Reclamation projects became clearer. Initially overly optimistic about the ability of water users to repay construction costs, Congress set a 10-year repayment period. Subsequently, the repayment period was increased to 20 years, then to 40 years, and ultimately to an indefinite period based on “ability to pay.” Other issues that arose included: soil science problems related both to construction and to arability (ability of soils to grow good crops); economic viability of projects (repayment potential) including climatic limitations on the value of crops; waterlogging of irrigated lands on projects resulting in the need for expensive drainage projects; and, the need for practical farming experience for people successfully to take up project farms. Many projects were far behind their repayment schedules, and settlers were vocally discontented.

The learning period for Reclamation and Congress resulted in substantial changes when the USRS was renamed the Bureau of Reclamation in 1923 and, in 1924, the Fact Finder's Act began major adjustments to the basic Reclamation program. Those adjustments were suggested by the Fact Finder's Report, which resulted from an indepth study of the economic problems and settler unrest on Reclamation's 20-plus projects. Elwood Mead, one of the

---

members of the Fact Finder's Commission, was appointed Commissioner of Reclamation in 1924 as the reshaping of Reclamation continued. A signal of the changes came in 1928, for instance, when Congress authorized the Boulder Canyon Project (Hoover Dam), and, for the first time, large appropriations began to flow to Reclamation from the general funds of the United States instead of from public land revenues and other specific sources.

In 1928, the Boulder Canyon Act ratified the Colorado River Compact and authorized construction of Hoover Dam, which was a key element in implementation of the compact. Subsequently, during the Great Depression, Congress authorized almost 40 projects for the dual purposes of promoting infrastructure development and providing public works jobs. Among these projects were the beginnings of the Central Valley Project in California, the Colorado-Big Thompson Project in Colorado, and the Columbia Basin Project in Washington.

Ultimately, of Reclamation's more than 180 projects, about 70 were authorized before World War II, but the remainder were authorized during and after World War II in both small authorizations and major authorizations, such as the Pick-Sloan Missouri Basin Program (1944), the Colorado River Storage Project (1956), and the Third Powerplant at Grand Coulee Dam (1966). The last big project construction authorization occurred in 1968 when Congress approved the Colorado River Basin Project Act, which included the Central Arizona Project, the Dolores Project, the Animas-La Plata Project, the Central Utah Project, and several other projects.

## **Laboratories**

One problem confronted by Reclamation was laboratory testing of special problems. Testing was carried out in various locations such as Montrose and Estes Park, Colorado, and Colorado State University until 1946 when Reclamation located its primary laboratory at the Denver Federal Center. These research laboratories study modeling and designs for hydraulic structures, concrete technology, electrical problems, construction design innovations, groundwater, weed control in canals and reservoirs, various environmental issues, water quality, ecology, drainage, control of evaporation and other water losses, and other technical subjects.

## **Hydroelectric Generation**

Although the earliest hydroelectric plants on Reclamation projects went into operation in 1909, it was only during the 1930s that generation of hydroelectric power became a principal benefit of Reclamation projects. Reclamation built the major hydroelectric plant at Hoover Dam only after a hard public debate about whether the Federal Government should become involved in public power production or whether private power production should be the rule. It was the Hoover Dam precedent which ultimately allowed Reclamation to become a major hydroelectric producer. Once the issues received public airing at Hoover Dam, hydroelectric

---

projects became a feature of many Reclamation projects. Hydroelectric revenues have subsequently proved an important source for funding repayment of Reclamation project costs. In 1993, Reclamation had 56 powerplants online and generated 34.7 billion kilowatt-hours of electricity. In 1999, revenues from Grand Coulee hydroelectric generation equaled about two-thirds of Reclamation's entire appropriated budget.

## Reclamation and Interstate Waters

Allocation of the waters of the Colorado River was addressed in 1922 in Santa Fe when Secretary of Commerce Herbert Hoover moderated a meeting of commissioners representing Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. The meeting developed and signed the Colorado River Compact (Compact) to divide and allocate the waters of the Colorado River. For Reclamation, this is the most complex and difficult of the interstate compacts, and it was ratified by Congress in 1928 without the concurrence of Arizona. California and Arizona argued for years over how to calculate Arizona's share of the waters of the lower Colorado River. The Arizona legislature ratified the Compact only in 1944 and then later sued California over its interpretation of the Compact. The lawsuit lasted from 1952 until 1962. Concern over the Compact has only heightened over the years as it became increasingly apparent that there isn't consistently as much water in the Colorado River as was presumed by the signers and ratifiers of the Compact. In addition, the Compact did not anticipate the provision for 1.5 million acre-feet of water promised to Mexico in a 1944 treaty. Reclamation is deeply involved in these complicated Colorado River issues because Reclamation reservoirs largely store and regulate the flow of the Colorado River. Reclamation dams in the Upper Colorado River Basin deliver water to Glen Canyon Dam, which then stores the water in Lake Powell. From Lake Powell, the water is delivered in accordance with the terms of the Colorado River Compact to the Lower Colorado River Basin states. Once delivered to the Lower Colorado River Basin, Hoover Dam stores the water in Lake Mead.

The Colorado River Compact is the most complex and difficult of the interstate compacts. Reclamation is affected by other compacts all over the West where the waters of interstate streams are shared among States.

## Special Projects

Reclamation's traditional area of operation is the 17, arid, continental States of the West. Reclamation has, however, at times been assigned work outside that traditional operational area. For instance, during the late 1920s, Reclamation studied "planned group settlement" in the South in cut over areas and swamps. This project was supposed to create new farms, but it ultimately died as impacts of the Great Depression on the farm economy were recognized. Other projects in the eastern United States were also undertaken, and Reclamation's photograph collection includes hundreds of photographs from areas outside the arid West. Beginning in the 1930s, Reclamation studied possible projects in Hawaii, and in 1954,

---

Congress authorized investigations on Oahu, Hawaii, and Molokai among the Hawaiian Islands. In the 1940s and 1950s, Reclamation studied water development projects in Alaska and ultimately built the Eklutna Project outside of Anchorage. The Eklutna Project has since been transferred out of Reclamation.

## Indian Tribes

In the early years of its history, Reclamation was actively involved, in conjunction with the Indian Service, in irrigation projects for Indian Tribes, including the San Carlos, Blackfeet, and Yuma. However, the majority of Reclamation project water went to non-Indians. In the early years, Reclamation's mission to develop water supplies appeared to carry the potential for injuring the rights of Tribes. If non-Indians began using Reclamation-provided water, it was feared they would establish a senior right under the appropriation doctrine, leaving little or no water for the Tribes when they were ready to develop their reservation lands. In the landmark 1908 decision, *Winters v. United States*, the Supreme Court attempted to reconcile this potential conflict through the "Winters Doctrine." This case concerned the Milk River in Montana and actually delayed development of Reclamation's Milk River Project. The Winters Doctrine established the principle of reserved rights—Indian Tribes with reservations have reserved water rights in sufficient quantities to fulfill the purposes for which the reservation was established, *and* the date of the reserved right is the date of the treaty or Executive order setting aside the land. The dates of reserved rights generally are very early in relation to non-Indian settlement and, thus, establish very high priority for Indian water rights. Further, unlike appropriative water rights, a reserved water right does not have to have been used to remain in effect. A reserved right remains in effect regardless of how many years have passed. A congressionally authorized and funded Reclamation project could not take precedence over senior water rights. Thus, if a Tribe had senior reserved water rights, its right to the future development of reserved rights should not be affected legally by Reclamation project development. Nevertheless, there are situations in which Tribes have encountered difficulties in attempting to develop their senior reserved water rights for various reasons—situations the United States, with Reclamation's participation, is trying to address through the Indian water rights settlement program and other initiatives.

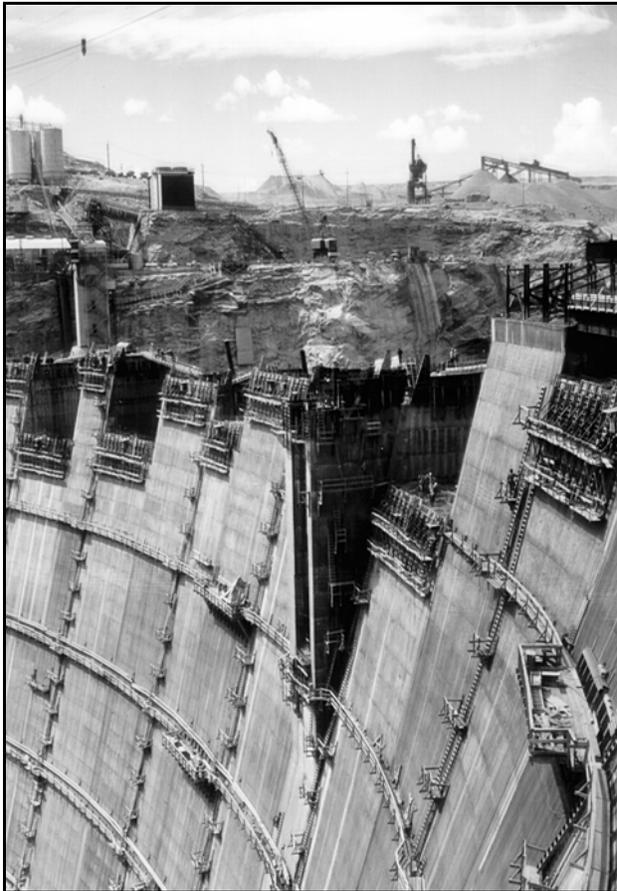
In recent years, the Government has become much more sensitive to Indian tribal water issues. Many Reclamation projects now include a provision for honoring the Secretary of the Interior's trust responsibility for Indian water rights. Among notable examples are the Central Arizona Project, the Dolores Project, and the currently proposed Animas-La Plata Project. Reclamation is also involved in water-related activities such as the Mni Wiconi water distribution system in South Dakota, which provides rural culinary water supply in a large area that includes several reservations. Reclamation personnel also often serve on negotiating teams or provide technical expertise to negotiating teams working for the Secretary of the Interior to develop equitable water solutions for Native American Tribes. Reclamation has also amended its procedures so that before any new actions are undertaken,

---

Reclamation first determines if the action could adversely impact Indian trust resources. When it appears that adverse impacts are possible, Reclamation will work with the Tribe to seek to avoid the impacts, or when unavoidable, to determine appropriate mitigation.

## Reclamation Projects and the Environment

Conservation and environmental issues are not as new to Reclamation as many think. The nature of conservation and environmental issues and how they have affected Reclamation, however, has changed considerably. Very early in Reclamation's history (between 1908 and 1912, for instance), there was a public outcry about conservation of Lake Tahoe's natural lake level and scenic beauty when Reclamation proposed to build a dam both to increase storage capacity and to sometimes lower the existing lake level to benefit the Newlands Project. In a distinctly different direction, Reclamation's Belle Fourche Project in South Dakota was specifically designed to avoid mixing hazardous industrial mining wastes in Whitewood Creek with its irrigation water.



*Glen Canyon under construction  
(Colorado River Storage Project, April 9, 1965).  
Photographer unknown.*

Subsequently, proposals for Reclamation projects raised public consciousness about major dams and their impacts on various resources. Reclamation, by the mid-1930s, was looking at fishery issues as it addressed construction of Grand Coulee and other dams. On another front, in the mid- to late-1930s, Coloradoans and their congressional representatives pushed Reclamation to build the Colorado-Big Thompson Project, which would require construction on the fringe of and under Rocky Mountain National Park. The project was ultimately built because Rocky Mountain National Park was created with a provision in the enabling law that specifically authorized a water development project infringing on the National Park. In the 1950s, the controversy over construction of Echo Park Dam in Dinosaur National Monument heightened public awareness of issues surrounding construction of a dam in a National Park Service-managed area. Ultimately, public opinion forced cancellation of plans for Echo Park Dam and resulted in construction of the

alternative, Glen Canyon Dam. By the 1960s, Marble Canyon and Bridge Canyon Dams were proposed, but Secretary of the Interior Stewart Udall canceled those dams because of public pressure in support of preserving parts of the Grand Canyon. Ironically, opposition was based at least partly on the public's belief that nuclear power generation was a viable alternative for meeting growing electric power needs in the West.

Although effects on the environment were always, to a limited extent, a part of Reclamation's work, during the 1960s, Reclamation's work began to change substantially as public awareness reached new heights. There was a change in America and the way Americans looked at natural resources exploitation. This change resulted, in part, from improved communication, which meant that the average American's news came not from newsreels, radio, and newspapers but from television, with same-day information and images which visually reinforced issues. It also came, in part, from transportation changes, which meant that the average American could travel to the "West" on airliners or in powerful cars on much-improved highways. Americans were coming to understand issues about the West and to consider the West "theirs." Thus, expanded knowledge and accessibility resulted in an increasingly proprietary feeling on the part of large new groups of Americans toward public lands and public works. At the same time, communities across the country began to pay increasing attention to water and air pollution issues. This new situation combined with far more sophisticated science and resultant understandings of the complex interactions of the communities of nature as well as of water and air pollution issues. Among other items, the effects of wetlands loss on fisheries and bird populations were better recognized. Improved understanding of the natural world and its issues combined with a shifting political power, which moved away from the rural and agrarian population and components of the economy to the urban population and components of the economy. The change was signaled in many ways. Wide-open, little-regulated exploitation of historic and natural resources, even on private property, lost support in America as effects on animals, birds, fishes, plants, water, air, archaeological sites, and historic sites were better recognized.

Rachel Carson's *Silent Spring* appeared in 1962 and increased public support for more environmentally sensitive project development. While even popular music expressed growing environmental concerns, increased public consciousness and support manifested itself in political action when Congress passed the Wilderness Act in 1964, the Fish and Wildlife Coordination Act in 1965, the National Historic Preservation Act in 1966, the Wild and Scenic Rivers Act of 1968, the National Environmental Policy Act (NEPA) of 1969, and many other subsequent laws. Accompanying and buttressing these Federal laws were presidential Executive orders, Federal regulations, and State and local laws, orders, and regulations.

The specific effects of Reclamation projects were also better identified in this period. Dam construction affected fish populations and often altered the flow characteristics and ecology of rivers and streams. Land "reclamation" and construction projects affected plant, animal, fish, and bird populations through displacement or destruction because of ecological changes. In addition, land development often destroyed historic or archeological resources.

---

Destruction of non-arable wetlands was a special environmental problem. Hydroelectric production, often considered pollution-free, was recognized as carrying environmental effects because of altered water temperatures, effects on native fish populations, effects on migratory fish, and water fluctuations. Environmental issues that conflicted with traditional bureau missions were not unique to Reclamation. Americans identified long menus of environmental effects throughout construction and natural resources exploitation programs in both the Government and private sectors in American society.

After a period of adjustment to the new laws and regulations, and as a result of increasing public and political pressure, Reclamation developed staffs to deal with environmental and historic preservation issues. Reclamation invests a great deal of time and money in issues such as endangered species, instream flows, the preservation and enhancement of quality freshwater fisheries below dams, preserving wetlands, conserving and enhancing fish and wildlife habitat, dealing with Endangered Species Act issues, controlling water salinity and sources of pollution, groundwater contamination, and the recovery of salmon populations on both the Columbia/Snake and the San Joaquin/Sacramento River systems. Reclamation implemented “reoperation” (revision of the way hydroelectric power generation is scheduled and carried out) of hydroelectric facilities at Glen Canyon Dam on the Colorado River to better achieve environmental objectives. Reclamation has made costly modifications to dams such as Shasta and Flaming Gorge to achieve environmental goals. There is a major effort underway among Federal and State agencies and other interest groups to improve environmental and water quality in the delta at the mouth of the Central Valley of California where the San Joaquin and Sacramento Rivers join and flow into San Francisco Bay.

Ironically, Reclamation’s attempts to use drainage water to support environmental objectives at the Kesterson National Wildlife Refuge in the Central Valley of California resulted in unexpected and difficult environmental problems. The drainage water mobilized selenium and concentrated it in water of the refuge, causing death and deformity among the affected animal populations. The selenium issue was a problem neither Reclamation nor the Fish and Wildlife Service foresaw, and it has been resolved.

## **Recreation**

Reclamation reservoirs provide flatwater recreation opportunities all over the West. While westerners quickly identified and began to enjoy recreation opportunities on and in the water captured behind dams on Reclamation projects, however, recreation was not recognized legally as a project use until 1937. Reclamation transferred Lake Mead, behind Hoover Dam, to the National Park Service for recreation management in 1936 and initiated the still-existing pattern of seeking other agencies to manage recreation at Reclamation facilities. That pattern means that today Reclamation manages only about one-sixth of the recreation areas on its projects. From the 1930s to the early 1960s, authorizations for recreation identified specific

---

projects, but in the mid-1960s, Congress began to give Reclamation more generalized authorities for funding recreation on all projects. Fishing, hunting, boating, picnicking, swimming, and other recreational opportunities developed over the years.

In 1992, Reclamation had over 300 recreation areas on its projects with almost 5 million acres of land (a little less than five-eighths of Reclamation-controlled Federal lands) open to various recreational uses. In recent years, Reclamation has “reoperated” some facilities, seeking to improve recreational fishing, commercial fishing, and white water recreational opportunities. Three recreation areas managed by the National Park Service—Lake Roosevelt behind Grand Coulee Dam, Lake Mead behind Hoover Dam, and Lake Powell behind Glen Canyon Dam, as well as the U.S. Forest Service’s Shasta Lake behind Shasta Dam—are among the most prominent recreation areas on Reclamation projects. Other managing partners for recreation areas include other Federal agencies, State agencies, counties, and cities. These partnerships result annually in millions of recreation days of use on Reclamation projects and raise numerous issues in terms of interagency coordination, water quality, public safety, public access, cost-sharing, law enforcement, etc. As water is converted from rural to urban uses in the West, resulting in urban population increases, recreation visits to Reclamation projects are expected to increase.

### **Flood Control/Drought Benefits**

Flood control is one of the benefits provided on many Reclamation projects. Reclamation’s facilities are operated in a way that prevents millions of dollars of flood damage annually. In the 42 years between 1950 and 1992, Reclamation projects with the most flood control benefits prevented in excess of 8.3 billion dollars in flood damage.

Flood control is needed in very wet years. In drought periods, Reclamation becomes involved in drought management activities. In some cases, Reclamation projects fare better than other water users because many Reclamation projects have carryover storage, which can provide water during a few consecutive years of drought. In some areas, however, growing demand stresses the water supply even in normal water years. Water shortages, often drought-influenced, will probably increase in the Reclamation West, thus forcing more effective and efficient use of the water supply. Possible Reclamation drought activities are quite varied (e.g., assisting water users with planning during drought periods for use and allocation of limited water supplies, participating in cooperative contingency planning for future drought, water conservation, loans, involvement in water banking, deepening wells, and water purchases).

### **International and Other Assistance**

International assistance is an important aspect of Reclamation’s program. Reclamation employees have worked in more than 80 countries, providing technical assistance on a wide

---

range of water resources issues, and Reclamation has welcomed more than 10,000 visitors from nearly every country in the world to its facilities. Reclamation routinely provides training programs for foreign visitors. All this activity is done in accordance with United States policy and in cooperation with the U.S. State Department.

In addition, Reclamation provides technical water assistance within the United States to various public and private entities through a variety of programs.

## **Reclamation Today**

Reclamation currently has more than 180 projects in the 17 Western States, which are managed out of 22 area offices. The area offices are within five regions, which are organized around western watersheds. Many projects are actually operated and maintained by the water users on the projects. Reclamation's projects provide agricultural, municipal, and industrial water to about one-third of the population of the West. Farmers on Reclamation projects produce about 13 percent of the value of all crops in the United States, including about 65 percent of all vegetables and 24 percent of all fruits and nuts. As a result of initiatives under the presidency of Bill Clinton, Reclamation's staffing level is about one-fifth smaller than it was in 1993; and as Reclamation enters into additional partnerships with the beneficiaries of the water and electricity produced on its projects, Reclamation's budgets and staffing levels are expected to shrink even further in the 21<sup>st</sup> century.

Learn more about Reclamation's history and history program at:

<<http://www.usbr.gov/history>>

Learn more about Reclamation's current programs and activities at:

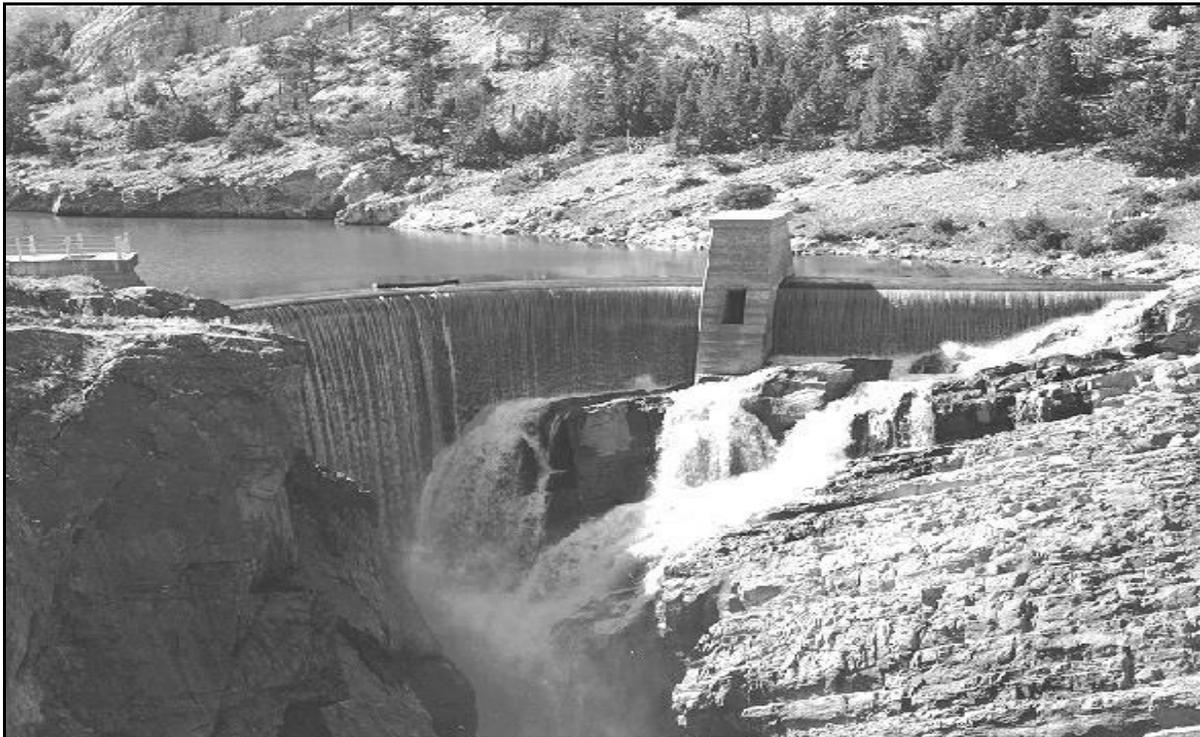
<<http://www.usbr.gov>>

---

## SELECTED READINGS IN THE HISTORY OF THE BUREAU OF RECLAMATION

### Introduction to the Selected Readings List

Readers in the history of the Bureau of Reclamation (Reclamation) will quickly learn that writers differ markedly on how to interpret its past. Historical accounts about Reclamation often, more so than for other Department of the Interior bureaus, have been colored sharply by their time and by the personal views of the author. Writers, over time, have perceived Reclamation as both hero and villain. Historical interpretation of Reclamation is a very complex task because a constantly evolving body of legislation, decisions, policies, and politics has combined with the changing economic health of the nation to shape Reclamation over nearly a century.



*Sun River Diversion Dam, Sun River Project, Montana.*

This “Selected Reading List” is an attempt to provide a starting point for readers interested in the history of Reclamation or the evolution of Western water policy and development. Various, occasionally extreme, points of view are represented in this list. Before arriving at final conclusions about the difficult public policy issues raised by Reclamation’s historic role in Western water development and management, the careful researcher will read fairly extensively. Charles Wilkinson’s *Crossing the Next Meridian* contains a brief overview of Reclamation’s history and evolution that is generally good, and readers might find that a useful place to begin looking at Reclamation’s history.

---

### ***Primary and Original Records Related to Bureau of Reclamation History***

Unlike the situation with most other Federal agencies, researchers in the history of Reclamation will find Reclamation's historic records concentrated in one location—the National Archives and Records Administration (NARA) branch on the Denver Federal Center in Lakewood, Colorado. Records held there include over 9,000 cubic feet of material which include correspondence, memoranda, project histories, construction notes, drawings, plans and maps, and photographs. More recent Reclamation records of interest to researchers are held in Reclamation offices in Washington, D.C. and Denver, regional offices, area offices, and field offices.

In addition, the records of the Secretary of the Interior and of other Federal agencies may be useful research sources. These records are located in NARA in College Park, Maryland, and in various Federal offices and NARA branches in the West.

Reclamation also has an active history research program aimed at writing brief narrative histories of each Reclamation project and obtaining oral history interviews with a broad range of Reclamation employees. While available through the history program, these materials are also deposited at the Department of the Interior's Library and the Library of Congress in Washington, D.C., the Beineke Library at Yale University, the Western History Collection of the Denver Public Library, the Heritage Center at the University of Wyoming, the Newberry Library in Chicago, the Huntington Library in San Marino, California, and the Water Resources Center Archives at the University of California in Berkeley.

Learn more about Reclamation's history and history program at:

<<http://www.usbr.gov/history>>

Learn more about Reclamation's current programs and activities at:

<<http://www.usbr.gov>>

---

---

---

## Mission

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

---

---



The purpose of this bulletin is to serve as a medium of exchanging operation and maintenance information. Its success depends upon your help in obtaining and submitting new and useful operation and maintenance ideas.

Advertise your district's or project's resourcefulness by having an article published in the bulletin—let us hear from you soon!

Prospective articles should be submitted to one of the Bureau of Reclamation contacts listed below:

Jerry Fischer, Technical Service Center, ATTN: D-8470, PO Box 25007, Denver, Colorado 80225-0007; (303) 445-2748, FAX (303) 445-6381; email: [jfischer@do.usbr.gov](mailto:jfischer@do.usbr.gov)

Vicki Hoffman, Pacific Northwest Region, ATTN: PN-3234, 1150 North Curtis Road, Boise, Idaho 83706-1234; (208) 378-5335, FAX (208) 378-5305

Steve Herbst, Mid-Pacific Region, ATTN: MP-430, 2800 Cottage Way, Sacramento, California 95825-1898; (916) 978-5228, FAX (916) 978-5290

Albert Graves, Lower Colorado Region, ATTN: BCOO-4846, PO Box 61470, Boulder City, Nevada 89006-1470; (702) 293-8163, FAX (702) 293-8042

Don Wintch, Upper Colorado Region, ATTN: UC-258, PO Box 11568, Salt Lake City, Utah 84147-0568; (801) 524-3307, FAX (801) 524-5499

Dave Nelson, Great Plains Region, ATTN: GP-2400, PO Box 36900, Billings, Montana 59107-6900; (406) 247-7630, FAX (406) 247-7898